LCAST

User Manual

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Welcome to LCAST Loudness Meter

MeterPlugs LCAST Loudness Meter is an advanced metering system designed for the content creator, the broadcaster and ultimately the audience. Digital transmission of content allows for multi-channel audio and increased dynamic range, but must be managed properly to ensure a consistent, enjoyable listening experience. LCAST provides you with a comprehensive set of tools for measuring, analyzing and *understanding* the loudness characteristics of programmes. Its minimalist, elegant interface is approachable and helps to simplify the process of measuring loudness. This guide will introduce you to the concepts behind loudness and true-peak metering, and then take you on a tour of LCAST Loudness Meter. We at MeterPlugs would like to thank you for choosing LCAST and welcome you to the future of metering!

System Requirements

- Mac OS X v10.5.7 or greater
- Windows XP, Vista, 7 or 8
- AAX, Audio Unit, or VST 2.4 compatible DAW

Compatibility

Mac

LCAST comes in three versions on the Mac: an AAX plug-in for Pro Tools (10.3.7+), an Audio Unit and a VST 2.4 plug-in. All plug-ins are 32/64-bit universal binaries.

Windows

LCAST is available as a 32/64-bit AAX plug-in for Pro Tools (10.3.7+) and a VST 2.4 plug-in on Windows.

Installation and Authorization

Mac

To install LCAST on Mac OS X, run the installer and follow the on-screen instructions. LCAST will be installed into the following folders:

- *AAX: /Library/Application Support/Avid/Audio/Plug-Ins/*
- *AU: /Library/Audio/Plug-Ins/Components/*
- *VST: /Library/Audio/Plug-Ins/VST/*

Most DAWs will scan these folders to discover plug-ins. See your DAW's manual for more information.

Windows

To install LCAST on Windows, run the installer and follow the on-screen instructions. LCAST will be installed into the following folders by default:

- *AAX: C:\Program Files\Common Files\Avid\Audio\Plug-Ins*
- *VST: C:\Program Files\Steinberg\VSTPlugins*

You may need to configure your DAW to scan this directory. See your DAW's manual for more information.

Authorization

When you first install and run LCAST, an authorization dialog will prompt you for your e-mail address and serial number. The e-mail address must be the one that you used when purchasing LCAST.

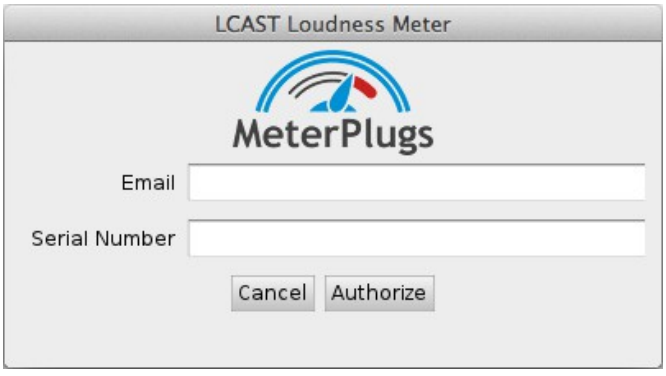


Figure 1: LCAST Authorization

Authorizing LCAST using the authorization dialog (Figure 1) requires an Internet connection. If you prefer, it is possible to authorize LCAST without an Internet connection by performing the following steps:

- Create a text file named *lcast-license.txt* (*lcast-stereo-license.txt* for LCAST Stereo) containing the e-mail address that you used when purchasing LCAST, your serial number and the license signature, each on a separate line. A sample license file is shown below.
- Place *lcast-license.txt* (*lcast-stereo-license.txt*) in the same directory that LCAST is installed in. For example, */Library/Audio/Plug-Ins/Components/* on Mac OS X or *C:\Program Files\Steinberg\VSTPlugins* on Windows.

Once LCAST has been successfully authorized, the authorization dialog will no longer be displayed when LCAST is run. If you have difficulty authorizing LCAST, try the following:

- If you are authorizing LCAST using the authorization dialog (Figure 1), ensure that you are connected to the Internet.
- If you create the license file manually, make sure it is a plain text file.
- Contact us! We're happy to assist you!

Sample License File

your.email@yourdomain.com
LCT10-C8H2Z-Y24QB-Q8XNT-2H4EN
MC4CFQCXPK4UfE3vWzW07lUxB6F8o0yhpgIVAMPXs1lsfl3ZguJvm+3LhVWtjBSv

Loudness Metering

When talking about loudness, an important question arises: how is loudness measured? The human ear is generally most sensitive to signals in the 1 kHz – 5 kHz range. Frequencies lower and higher than this, when played at the same volume level, are perceived as being quieter. Many factors can affect the perception of loudness: the age of the listener, the duration of a burst of loudness, the overall loudness of a passage and the mixture of frequencies. We desire a meter that mimics the way a human perceives loudness – a so-called "perceived" or "subjective" loudness meter.

Such a meter improves upon peak, root-mean-square (RMS) and voltage unit (VU) meters by more accurately modeling human hearing. This allows broadcasters to provide more uniform loudness levels across programmes, leading to a more enjoyable listening experience. For this reason, loudness metering is quickly becoming standard practice in broadcast.

Loudness Units

The basic unit of loudness is LUFS, which stands for Loudness Unit, referenced to full-scale. An equivalent unit, LKFS, stands for Loudness, K-weighted referenced to full-scale. When loudness values are referenced to a target level, rather than full-scale, the relative unit of loudness is LU, which stands for Loudness Unit. For example, if the target level is -23 LUFS then 1 LU is the same as -22 LUFS.

Loudness levels can apply to an entire multi-channel programme or to a small portion of that programme. In other words, we can say things like, "this song's loudness is -23 LUFS" or "the momentary loudness over the past 400 ms is -24 LUFS."

Loudness Range

In addition to knowing how loud a programme is, we also wish to know how much its loudness varies. A programme with a constant loudness of -23 LUFS may need to be treated differently than one that fluctuates between -40 LUFS and -10 LUFS, for example. Loudness range quantifies the loudness variation in a programme and is expressed in LUs.

Gating

Long, quiet passages in a programme will lower loudness readings. For example, in a movie, dialogue between two characters may contain pauses. If these pauses last a prolonged period of time, they will lower the loudness measurement. To account for this, gating is used to ignore passages that have loudnesses under a given threshold. LCAST supports both gated and un-gated measurements.

True-Peak Metering

Many peak meters fail to accurately detect peaks in audio signals because they don't detect inter-sample peaks (peaks occurring between samples). Inter-sample peaks may be created when a DA converter interpolates between digital samples in order to create a continuous analog signal. Inter-sample peaks are quite common so it is important to detect them. LCAST uses true-peak metering to improve the accuracy of peak detection by quadrupling the number of samples in an input signal before detecting peaks.

LCAST User Interface

This section describes the LCAST user-interface (UI) components, which are identified by numbered circles, 1 through 7, in Figures 2 and 3.

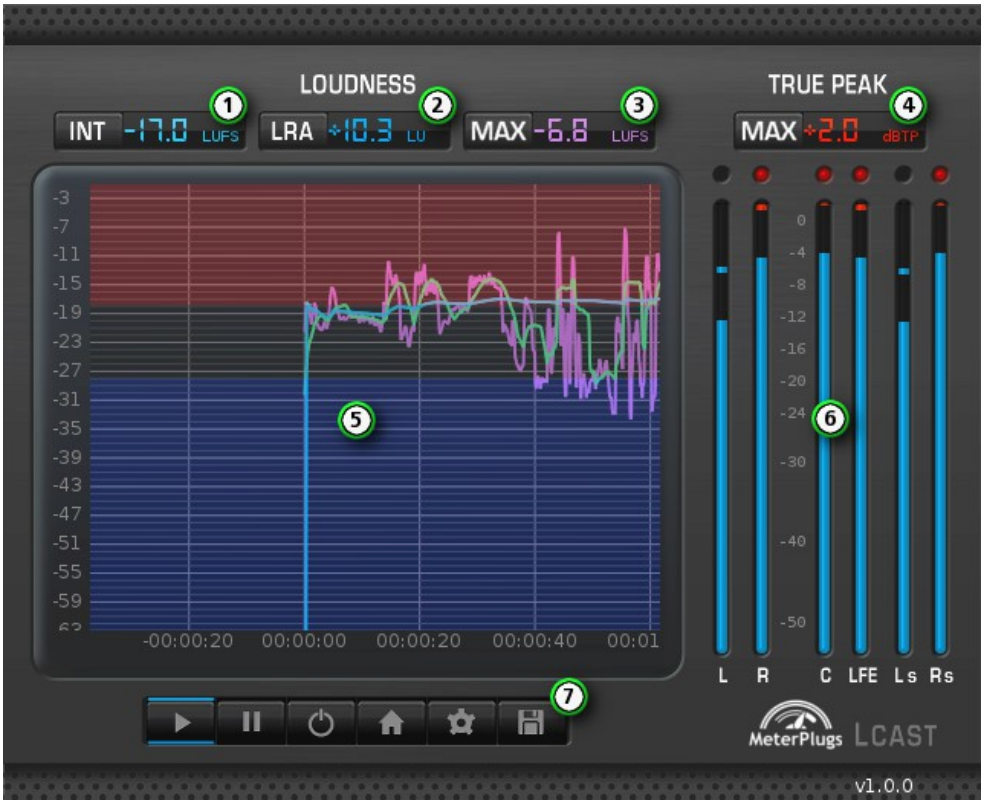


Figure 2: LCAST User Interface

1. Integrated Loudness

Integrated (programme) loudness quantifies the overall loudness of the entire programme. Many loudness requirements specify a target value for integrated loudness. The unit of loudness is LUFS when the alignment level is 0 (see the Options panel below) and LU otherwise.

2. Loudness Range

Loudness range gives an indication of the variation present in the integrated loudness measurement and is useful for determining whether dynamic compression is needed. The

unit of loudness range is LU.

3. Maximum Momentary Loudness

Maximum momentary loudness measures the greatest level that the momentary loudness measurement reaches. This value is useful for limiting loudness peaks in short programmes (less than 30 s).

4. Maximum True-Peak

The maximum true-peak display shows the highest peak level reached on all channels. The display turns red when the clip threshold is exceeded (see the Options panel below). The unit for true-peak levels is dBTP, which stands for decibels, true-peak.

5. History Plot

The history plot depicts the integrated, short-term and momentary loudness levels over time. Each series can be shown or hidden (see the Options panel below). Click and drag the plot to pan up or down. Shift + click and drag the plot to zoom in or out. Press the home button to restore the default plot bounds, which can be adjusted in the Options panel.

6. True-Peak Meters

Each meter displays a channel's true-peak and maximum true-peak level. When the true-peak level exceeds the true-peak clip level, as set in the Options panel, the clip indicator light turns on. Click the clip indicator light to reset the meter's maximum true-peak level.

7. Control Strip

- **Play Button** – Start/stop all loudness and peak measurements.
- **Pause Button** – Pause/resume all loudness and peak measurements. This is useful when you want to disregard portions of a programme.
- **Reset Button** – Reset all loudness and peak measurements.
- **Home Button** - Restore the default history plot bounds, as set in the Options panel.
- **Options Button** - Open the Options panel.

- **Save Button** – Save loudness and peak data to a file. This is useful when you want to analyze loudness and peak data in an external application. This feature is only available in LCAST Surround.

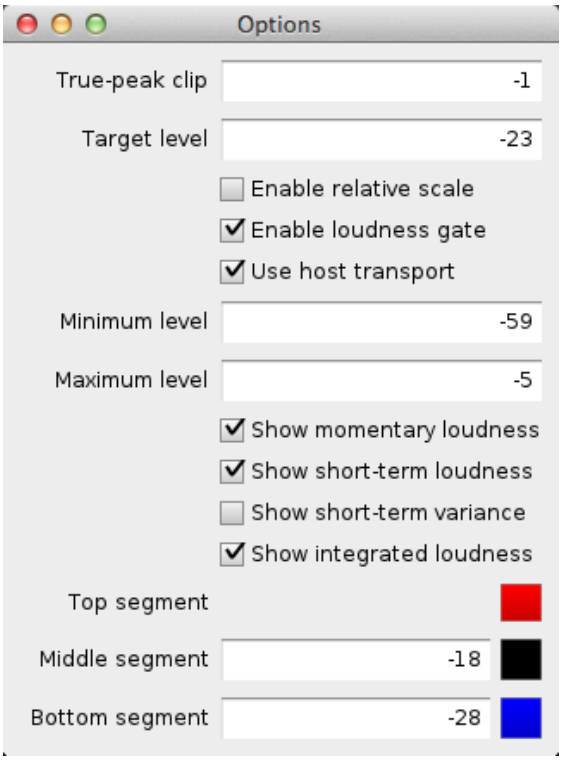


Figure 3: Options Window

Options Panel

- **True-peak clip** - The threshold over which a peak level is considered to be clipped. When this value is exceeded, the maximum true-peak display (4) turns red and displays the offending peak level.
- **Target level** – The desired integrated loudness level (LUFS). This option is used in conjunction with the relative scale toggle.
- **Enable relative scale** – When enabled, loudness levels are displayed on a relative scale. The target level is subtracted from the full-scale loudness value and the unit of loudness is LU, a relative level. For example, if the target level is set to -23 LUFS, then -22 LUFS is equivalent to +1 LU.
- **Enable loudness gate** - The loudness gate is designed to disregard quiet portions

of the programme so that the integrated loudness and loudness range are not greatly affected by them. An absolute gate of -70 LUFS and a relative gate of -10 LU are used. This parameter takes effect when a new integrated measurement is started.

- **Use host transport** – Bypass LCAST when the host transport is not playing. This feature is not supported by all hosts.
- **Minimum/Maximum level** - The default minimum/maximum value shown in the history plot. If the plot is panned, press the home button to restore these values.
- **Show momentary/short-term/integrated loudness and loudness variance**- Show or hide the history plot series for each of these measurements.
- **Top/middle/bottom segment** – Set the colors and levels of the history plot's background segments. Click the color buttons to open a color chooser.

Your First Loudness Measurement

Momentary, short-term and integrated loudness levels are shown in LCAST's history plot. Momentary and short-term measurements are updated continuously while the integrated measurement is updated when the play button is toggled on and the pause button is toggled off.

To determine the integrated loudness of an entire programme, perform the following steps:

- Insert LCAST on your DAW's output bus and open the LCAST UI.
- Toggle LCAST's play button to start the integrated loudness measurement.
- Press your DAW's play button to start the programme.
- When the programme is finished, toggle LCAST's play button to stop the measurement.
- Take note of the integrated loudness, loudness range, maximum momentary loudness and maximum true-peak levels. If they do not meet your requirements, make the necessary gain, compression and limiting adjustments and repeat the previous steps until you obtain the desired levels.

Pre and Post Silence

Ideally, LCAST's loudness measurement would start immediately when your DAW starts playing the programme and stop when your DAW stops. Be aware that some DAWs send a silent signal through plug-ins even when no audio is playing. For gated measurements, this is usually not a problem since any pre and post silence is ignored; however, short, un-gated measurements may be biased slightly by this silence. For example, if 2 s of silence are fed into LCAST before a short 5 s clip, the loudness reading may be compromised. It is important to be aware of this when taking un-gated measurements.

Presets and Loudness Standards

LCAST includes presets for the major loudness standards and can be configured to support others. A loudness standard specifies a set of loudness and true-peak requirements: target levels for integrated loudness and maximum levels for momentary, short-term and true-peak measurements. This helps to create consistency between programmes which should lead to a more enjoyable listening experience. What follows is a brief overview of the most popular loudness recommendations.

ITU BS.1770-3

This document, created by the International Telecommunications Union (ITU), contains algorithms for measuring perceived loudness and true-peak levels of multi-channel signals. The loudness algorithm computes a single loudness value for an entire programme, which is expressed in LKFS. Two loudness gates are used to filter out quiet passages so that they do not bias the measurement. The first gate is an absolute gate with a threshold of -70 LKFS while the second gate is a relative gate with a threshold of -10 LKFS.

EBU R128

This document, created by the European Broadcast Union (EBU), covers loudness metering specifications and recommended loudness practices for broadcasters. EBU R128 defines three loudness measurements: integrated, short-term and momentary. Integrated loudness is computed using the loudness algorithm listed in ITU BS.1770-2 while short-term and momentary loudness are computed using 3 s and 400 ms windows, respectively. The unit of loudness is LUFS, which is equivalent to LKFS. When loudness values are given relative to a non-zero target loudness, the relative unit of loudness is LU. EBU R128 recommends that programmes be normalized to -23 LUFS using the gating scheme described in ITU BS.1770-2.

ATSC A/85

This document, created by the Advanced Television Systems Committee (ATSC), covers recommended practices for loudness metering and content delivery. A/85 recommends a target loudness of -24 LUFS, un-gated, measured over the entire duration of the programme, for content delivery and exchange. For live events, it recommends a sliding

window measurement that is 3 s - 10 s in duration.

iTunes Sound Check

This iTunes feature allows you to hear all of our songs at a similar volume. Although Apple has not publicly stated how they perform volume normalization, independent tests suggest that songs are normalized to -16.5 LUFS.

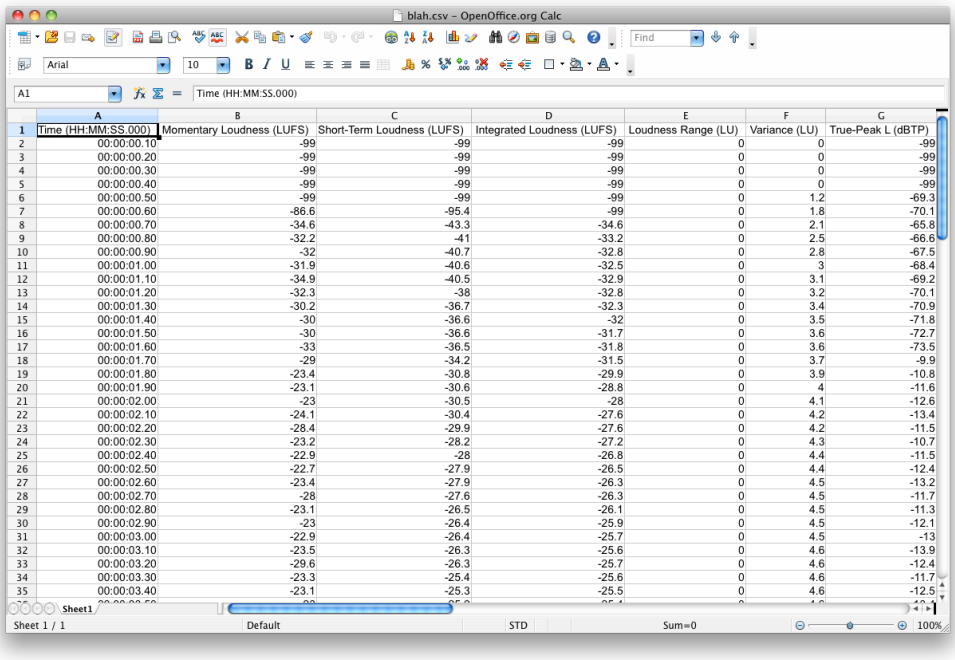
Presets

LCAST has the following presets:

- ATSC A/85
- EBU R128 LUFS
- EBU R128 LU +9
- EBU R128 LU +18
- ITU BS.1770-3
- iTunes Sound Check
- OP-59

Exporting Loudness Data

In LCAST Surround, you can export the data displayed in the history plot, saving it to a comma-separated values (CSV) file, which can be opened in a spreadsheet application such as Microsoft Excel or OpenOffice. Press the save button to export a log file.



Time (HH:MM:SS.000)	Momentary Loudness (LUFS)	Short-Term Loudness (LUFS)	Integrated Loudness (LUFS)	Loudness Range (LU)	Variance (LU)	True-Peak L (dBTP)
00:00:00.10	-99	-99	-99	0	0	-99
00:00:00.20	-99	-99	-99	0	0	-99
00:00:00.30	-99	-99	-99	0	0	-99
00:00:00.40	-99	-99	-99	0	0	-99
00:00:00.50	-99	-99	-99	0	1.2	-69.3
00:00:00.60	-86.6	-95.4	-99	0	1.8	-70.1
00:00:00.70	-34.6	-43.3	-34.6	0	2.1	-65.8
00:00:00.80	-32.2	-41	-33.2	0	2.5	-66.6
00:00:00.90	-32	-40.7	-32.8	0	2.8	-67.5
00:00:01.00	-31.9	-40.6	-32.5	0	3	-68.4
00:00:01.10	-34.9	-40.5	-32.9	0	3.1	-69.2
00:00:01.20	-32.3	-38	-32.8	0	3.2	-70.1
00:00:01.30	-30.2	-36.7	-32.3	0	3.4	-70.9
00:00:01.40	-30	-36.6	-32	0	3.5	-71.8
00:00:01.50	-30	-36.6	-31.7	0	3.6	-72.7
00:00:01.60	-33	-36.5	-31.8	0	3.6	-73.5
00:00:01.70	-29	-34.2	-31.5	0	3.7	-9.9
00:00:01.80	-23.4	-30.8	-29.9	0	3.9	-10.8
00:00:01.90	-23.1	-30.6	-28.8	0	4	-11.6
00:00:02.00	-23	-30.5	-28	0	4.1	-12.6
00:00:02.10	-24.1	-30.4	-27.6	0	4.2	-13.4
00:00:02.20	-28.4	-29.9	-27.6	0	4.2	-11.5
00:00:02.30	-23.2	-28.2	-27.2	0	4.3	-10.7
00:00:02.40	-22.9	-28	-26.8	0	4.4	-11.5
00:00:02.50	-22.7	-27.9	-26.5	0	4.4	-12.4
00:00:02.60	-23.4	-27.9	-26.3	0	4.5	-13.2
00:00:02.70	-28	-27.6	-26.3	0	4.5	-11.7
00:00:02.80	-23.1	-26.5	-26.1	0	4.5	-11.3
00:00:02.90	-23	-26.4	-25.9	0	4.5	-12.1
00:00:03.00	-22.9	-26.4	-25.7	0	4.5	-13
00:00:03.10	-23.5	-26.3	-25.6	0	4.6	-13.9
00:00:03.20	-29.6	-26.3	-25.7	0	4.6	-12.4
00:00:03.30	-23.3	-25.4	-25.6	0	4.6	-11.7
00:00:03.40	-23.1	-25.3	-25.5	0	4.6	-12.5

Figure 4: Exported Loudness Data

LCAST Surround exports the following columns:

- Time (HH:MM:SS.000)
- Momentary loudness (LUFS)
- Short-term loudness (LUFS)
- Integrated loudness (LUFS)
- Loudness range (LU)
- Variance (LU)
- True-peak levels for all channels (dBTP)

Channel Layouts

In DAWs that support channel layout information, LCAST Stereo reports to the DAW that it supports the following channel layouts:

- Mono
- Stereo (L R)

LCAST Surround also supports the following channel layouts:

- MPEG 3.0 (L R C)
- Quadraphonic (L R Ls Rs)
- MPEG 5.0 (L R C Ls Rs)
- MPEG 5.1 (L R C LFE Ls Rs)

In DAWs that do not support channel layout information, LCAST will map the input channels as follows:

- Channel 1: L
- Channel 2: R
- Channel 3: C
- Channel 4: LFE
- Channel 5: Ls
- Channel 6: Rs

When you insert LCAST into a new project, verify that the channels are mapped correctly or you may obtain incorrect loudness readings.

Resources

MeterPlugs
http://www.meterplugs.com

ATSC A/85
http://www.atsc.org/cms/standards/a_85-2011a.pdf

EBU R128
http://tech.ebu.ch/webdav/site/tech/shared/r/r128.pdf

EBU TECHNICAL - Loudness
http://tech.ebu.ch/loudness

ITU BS.1770-2
http://www.itu.int/dms_pubrec/itu-r/rec/bs/R-REC-BS.1770-2-201103-I!!PDF-E.pdf

Glossary

ATSC Abbreviation for *Advanced Television Systems Committee*.

DA Abbreviation for *digital-to-analog*. Digital-to-analog conversion is the process of constructing a continuous analog signal from a discrete digital signal.

DAW Abbreviation for *digital audio workstation*. A digital audio workstation is a piece of software that acts as a virtual studio, often allowing you to record, edit and mix audio tracks.

dBTP Abbreviation for *decibels, true-peak*.

EBU Abbreviation for *European Broadcast Union* (www.ebu.ch).

LKFS Abbreviation for *loudness, k-weighted referenced to full-scale*.

LU Abbreviation for *loudness unit*.

LUFS Abbreviation for *loudness unit, referenced to full-scale*.

ITU Abbreviation for *International Telecommunication Union* (www.itu.int).

RMS Abbreviation for *root-mean-square*. Calculating the root mean square of a signal's samples can give an indication of the power in the signal.